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Perspective

Water for animal products: a blind spot in water policy

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Abstract
We know from land, energy and climate studies that the livestock sector plays a substantial role in deforestation, biodiversity loss and climate change. More recently it has become clear that livestock also significantly contributes to humanity's water footprint, water pollution and water scarcity. Jalava *et al* (*Environ. Res. Lett.* **9** 074016) show that considerable water savings can be achieved by reducing the fraction of animal products in our diet. The findings are in line with a few earlier studies on water use in relation to diets. As yet, this insight has not been taken forward in national water policies, which focus on 'sustainable production' rather than 'sustainable consumption'. Most studies and practical efforts focus on increasing water-use efficiency in crop production (more crop per drop) and feed conversion efficiency in the livestock sector (more meat with less feed). Water-use efficiency in the food system as a whole (more nutritional value per drop) remains a blind spot.

Keywords: water footprint, water saving, diet, livestock, meat, dairy

According to Steinfeld *et al* (2006), livestock takes 70% of all agricultural land and 30% of the planet's land surface. They argue that livestock is an important factor in global biodiversity loss: livestock accounts for 20% of total terrestrial animal biomass, and the 30% of the Earth's land surface now claimed by farm animals was once habitat for wildlife. Furthermore, they estimate that livestock is responsible for 18% of anthropogenic greenhouse gas emissions (in terms of CO_2 equivalents). Compared to crop products, animal products do not only require more land to obtain a certain nutritional value, but also more energy and water. Pimentel and Pimentel (2008) estimate that an average of 25 kcal of fossil energy is required to produce 1 kcal of animal protein, which is ten times greater than in the case of plant protein. Mekonnen and Hoekstra (2012) show that the water footprint (WF) of any animal product is larger than the WF of a crop alternative with equivalent nutritional value. For example, the average WF per calorie for beef ($10\,L\,kcal^{-1}$) is 20 times larger than for cereals and starchy roots ($0.5\,L\,kcal^{-1}$). The WF per gram of protein for milk, eggs and chicken meat (around $30\,L\,g^{-1}$ protein) is 1.5 times larger than for pulses ($20\,L\,g^{-1}$ protein).

Jalava *et al* (2014) find that a global shift from current diets (period 2007–2009) to recommended diets (following the dietary guidelines of the World Health Organization) and a replacement of animal products by nutritionally equivalent local crop products will reduce the food-related global green WF by 23% and the global blue WF by 16% (Jalava *et al*, table 4). Earlier, Hoekstra (2010) estimated a potential overall WF reduction of 36% in the industrialized world and 15% in the developing world. Vanham *et al* (2013) found a possible WF reduction of 41% for Southern and Western Europe and possible reductions of 27% and 32% for Eastern and Northern Europe, respectively. Unlike Jalava *et al*

(2014), the previous studies considered the effect of a replacement of meat only, leaving the consumption of dairy products.

About 92% of humanity's WF relates to agriculture (Hoekstra and Mekonnen 2012), thus food production is a key factor in freshwater scarcity. Animal products are responsible for nearly thirty per cent of the WF of the global agricultural sector (Mekonnen and Hoekstra 2012). Jalava *et al* (2014) point at a number of nuances to be brought into the discussion when proposing diet changes as a partial solution to water scarcity. First of all, the possible impact differs per country, depending on current dominant diets in a country. Obviously, countries where current meat consumption per capita is relatively high, like in the US and Australia, WF reductions through diet change can be most substantial. Second, we should distinguish between green and blue WF reductions. Jalava *et al* (2014) did not study this, but obviously we should also look at grey WF reductions specifically. Third, they point at the importance to look at where WF reductions are achieved: the immediate environmental benefit is greatest when WF reductions take place in water-scarce areas. However, I would add here that it matters less where precisely the saving takes place than one may think at first instance, because the key is that total global demand for land and water to produce food diminishes. Making sure that the world's food is produced in the best places—where environmental impacts of land and water allocation for food production are smallest—is a separate concern. Fourth, Jalava *et al* (2014) show that human health and environmental protection partly go together: following dietary guidelines will reduce the WF of our diet. This comes out more pronounced in Vanham *et al* (2013). Fifth, they point at the possible water saving by reducing waste, which was quantified for example by Liu *et al* (2013) for China. Sixth, they argue for a careful consideration of what crop substitutes for animal products to select in order to remain within dietary guidelines and stay close to typical local diets so that shifting becomes more realistic. A final point that should be added is the need to look more comprehensively at the livestock sector. Eating animal products is inefficient from the perspective of land, water and energy and undesirable from a biodiversity, climate change and animal welfare point of view (Smil 2013). The relatively high demand on our limited freshwater resources is just one specific entry point when talking about the need to rethink the consumption of animal products.

Despite the fact that animal products form the single most important factor in humanity's WF, water managers never talk about meat or dairy. Indeed, livestock farmers are rather invisible, because not big water users. It is the feed that takes so much water. The WF of animals is mostly accounted under crop farming. The fact that about 40% of the cereals produced in the world are used for animal feed (period 2001–2010; FAO 2014) is known by professionals in the agricultural sector, but not in the water sector. Water managers do not see the difference between water use for growing food or feed. The crops are often the same and the essential question for water managers is how to make sure there is sufficient water for crops; they do not address the question why crops are grown. However, the increasing scarcity of freshwater resources cannot be properly addressed without a careful examination of the large and still growing water needs for meat and dairy. Good water policy should include measures to confine the growth of the meat and dairy sector (Hoekstra 2013). No national water plan in the world addresses the issue that meat and dairy are among the most water-intensive consumer products, let alone that national water policies somehow involve consumers or the meat and dairy industry in this respect. Water policies focus on increasing water-use efficiency within agriculture and closing the 'water productivity gap' (Brauman *et al* 2013), but fail to address the issue of water-use efficiency in the food system as a whole. As Renault and Wallender (2000) already pointed out: we should consider the 'nutritional water productivity' of the global agricultural sector. For this reason, but also in the larger context of other problems related to the livestock sector, we need to re-examine the place meat and dairy have in the diet of modern man.

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